BY ORDER OF THE
SECRETARY OF THE AIR FORCE

AIR FORCE OCCUPATIONAL SAFETY AND HEALTH STANDARD 91-22

1 OCTOBER 1997

Safety

WALKING SURFACES, GUARDING FLOOR AND WALL OPENINGS AND HOLES, FIXED INDUSTRIAL STAIRS, AND PORTABLE AND FIXED LADDERS

OPR: HQ AFSC/SEGS
(SMSgt Pennie Hardesty)

Certified by: HQ AFSC/SEG (Colonel R W. Scott)

Supersedes AFOSH Standard 127-22,
22 September 1992

Pages: 31
Distribution: F

The criteria in this standard are the Air Force's minimum safety, fire prevention, and occupational health requirements for walking and working surfaces identified in the title. Major commands (MAJCOM), direct reporting units (DRU), and field operating agencies (FOA) may supplement this standard when additional or more stringent safety and health criteria are required. Refer to AFI 91-301, *Air Force Occupational and Environmental Safety, Fire Protection, and Health (AFOSH) Program,* for instructions on processing supplements or variances. Report conflicts in guidance between this standard, federal standards, or other Air Force directives through MAJCOM, DRU, or FOA ground safety offices to Headquarters Air Force Safety Center, Ground Safety Division, Safety Engineering and Standards Branch (HQ AFSC/SEGS), 9700 Avenue G, SE, Kirtland AFB, NM 87117-5670.

This standard applies to all US Air Force organizations, including all US Air Force Reserve personnel and when Air National Guard personnel are on federal service. Essential regulatory requirements contained in Occupational Safety and Health Administration (OSHA) 29 Code of Federal Regulations (CFR), Subpart D, *Walking--Working Surface,* 1910.21, *Definitions--Walking--Working Surfaces,* 910.22, *General Requirements,* 1910.23, *Guarding Floor and Wall Openings and Holes,* 1910.24, *Fixed Industrial Stairs,* 1910.25, *Portable Wood Ladders,* 1910.26, *Portable Metal Ladders,* 1910.27, *Fixed Ladders,* 1910.30, *Other Working Surfaces,* 1910.37, *Means of Egress, General,* 1910.176, *Handling Materials--General,* 1910.303, *General Requirements,* and 1910.333, *Selection and Use of Work Practices,* are included. It also contains material not addressed in OSHA Standards. OSHA cross-references are included at the end of applicable paragraphs. Military Specifications (Mil Spec) are provided as a reference source only. See your unit supply representative for assistance.

NOTE: AFOSH 127-series standards are being converted to 91-series standards and the 161-series standards to 48-series standards. However, not all standards have been converted as of the effective date of this standard. To help you locate these documents, references to AFOSH standards are stated in the updated series and standard number, with the outgoing series and standard number stated as "formerly designated as" in the 'references' section of Attachment 1.

SUMMARY OF REVISIONS

Administrative changes have been made to upgrade this standard to electronic format. Paragraphs have been renumbered and references updated. Figures have been deleted. A glossary of references, abbreviations, acronyms, and terms is at Attachment 1. A | indicates revisions from previous edition.

Chapter 1

INTERIOR AND EXTERIOR SURFACES

1.1. Hazards and Human Factors . Walking and working surfaces are the sources of many injuries and property damage mishaps. Relatively safe areas become hazardous because people fail to correct known deficiencies. The most common mishap is people falling as the result of slipping or tripping. Good design and maintenance, together with proper lighting, all contribute to a safe walking or working surface. Then it becomes the responsibility of the individual to wear proper footwear and to use walking surfaces in a safe manner. The primary reasons for walking surface mishaps are:

1.1.1. Physical Hazards:

1.1.1.1. Poor Housekeeping. Obstacles in walk areas, liquid spills, sawdust accumulations, and the use of slippery surface cleaners.

1.1.1.2. Dangerous Surface Condition. Cracks or holes, protruding nails, broken surface materials, slippery finishes, surfaces of different elevations, and improper design for the use intended.

1.1.1.3. Inadequate Lighting. Incorrect or insufficient lighting to make walking surfaces and obstacles visible.

1.1.2. Human Factors. Inattention to tasks, running, improper footwear (oversized heels and worn or slick soles), fatigue, and lack of familiarity with the work area are some of the causes for mishaps.

1.2. Requirements:

1.2.1. Interior Walking and Working Surfaces:

1.2.1.1. Layout. Proper layout, spacing, and arrangement of equipment, machinery, passageways, and aisles are essential to orderly operations and to avoid congestion. Good layout can best be achieved in the design stage, with recommendations from the base ground safety, fire protection, bioenvironmental engineering (BE), and civil engineering (CE) representatives. Whether a facility is in the design stage, being remodeled, or repositioning of equipment and machinery is required, basic layout considerations are an important factor in planning a facility for safe operations. All interior walking and working surfaces which are part of the means of egress shall comply with the requirements of National Fire Protection Association (NFPA) 101, *The Life Safety Code*.

1.2.1.1.1. Equipment and machinery will be arranged to permit an even flow of materials. Sufficient space should be provided to handle the material with the least possible interference from or to workers or other work being performed. Machines will be placed so it will not be necessary for an operator to stand in a passageway, aisle, or exit access. Additionally, machine positioning should allow for easy maintenance, cleaning, and removal of scrap. After the initial positioning of equipment and machines is decided, clear zones (workspaces) shall be established. These clear zones should be of sufficient dimensions to accommodate typical work. If material exceeds established clear zones, rope and stanchions may be used to temporarily extend the workspace. Marking of machine clear zones is optional. Base ground safety officials and the shop supervisor will determine machine shops that need clear zones marked based upon hazard potential. Yellow or yellow-and-black hash-marked lines, 2 to 3 inches wide will be used when marking is necessary. (29 CFR 1910.30)

1.2.1.1.2. Passageways, aisles, and exit accesses shall be provided to permit the free movement of employees bringing to and removing material from the shop. These passageways are independent of clear zones and storage spaces. They will be clearly recognizable. Markings will be used unless the number of workers and location of machines precludes this requirement. In these cases the base ground safety personnel will approve the exclusion. Floor markings should provide a contrast to the floor color, such as yellow lines 2 to 3 inches wide on a gray floor.

1.2.1.1.3. Where powered materials handling equipment is used, facility layout shall provide enough clearance in aisles, loading docks, and through doorways to permit safe turns. Aisles should be at least 2 feet wider than the widest vehicle used or most common material being transported. (29 CFR 1910.176)

1.2.1.1.4. At least 18 inches will be provided for passageways through or between obstructions. (Refer to NFPA Standard 101.)

1.2.1.1.5. Sufficient access and working space shall be provided and maintained around all electrical equipment. (29 CFR 1910.303)

1.2.1.2. Condition. Floors shall be kept in good condition and free of defects that can endanger workers or interfere with the handling of materials. They will not have obstructions which would create a tripping hazard or hinder people leaving the area during emergencies. (29 CFR 1910.22*)*

1.2.1.2.1. Floors of all shop areas, service rooms, halls, and storerooms shall be kept clean, free of oil, grease, gasoline, water, and other slippery substances. When slippery substances are spilled, they shall be immediately cleaned or covered with a noncombustible absorbent material. Drip or oil pans will be used whenever the possibility of spilling or dripping exists. (29 CFR 1910.22)

1.2.1.2.2. Floors shall not be cleaned with flammable liquids. When toxic cleaning agents are required, adequate ventilation and (or) respiratory protection shall be provided. Combustible or explosive dust should be eliminated at the source. If this is not possible, it should be minimized during sweeping by spreading a noncombustible sweeping compound over the floor.

1.2.1.2.3. After floors have been properly cleaned, nonskid finishing compounds may be used. In some locations, such as electroplating shops, finishing compounds should not be applied due to the possibility of a reaction to chemicals used during the processing.

1.2.1.2.4. Whether floors are being cleaned or finishing compounds are being applied, signs will be posted to warn workers of a slipping hazard and will remain in place until floors have dried. The size and placement of these signs will be at the discretion of the supervisor, but shall be visible to those entering the hazardous area. These caution signs will be yellow with black lettering.

1.2.1.2.5. Passageways, aisles, and exit accesses shall be kept clear for easy access to emergency equipment and to enable fire fighters to reach a fire. Additionally, areas adjacent to sprinkler control valves, fuse boxes, and electrical switch panels shall not be obstructed. NFPA Standard 70, *The National Electrical Code (NEC*), and other NFPA standards contain information on clearance distances.

1.2.1.3. Loading Capacity. Supervisors shall ensure that equipment weight and distribution comply with maximum floor loading capacity for all above grade (including areas above basement)

storage areas. This capacity is determined by the base CE. The weights of equipment, such as hoists suspended under a floor, will also be considered when determining floor loading capacity. The supervisor will have signs that identify the floor load capacity permanently installed in plain view of all workers. The base CE will approve the installation of all equipment weighing more than 500 pounds in any multi-story building. Supervisors will ensure heavy loads are evenly distributed according to the floor's safe load limit. (29 CFR 1910.22)

1.2.1.4. Floor Sloping, Drains, and Separators. Drains will be provided when floors are subject to water, moisture, flooding, or when wet processes (such as in battery and electroplating shops) are used. Floors will be sloped to allow liquids to naturally flow to the drains. Drains shall be kept clear to prevent clogging. Separators or other waste disposal controlling devices shall be used according to Air Force Joint Manual (AFJMAN) 32-10131V1, *Sanitary and Industrial Wastewater Collection, Gravity Sewers, and Appurtenances,* and AFJMAN 32-10131V3, *Domestic Wastewater Treatment*.

1.2.1.5. Illumination. All aisles, passageways, and work areas will be adequately lighted. The base bioenvironmental engineer (BEE) shall be consulted for guidance on adequate lighting for specific locations; however, a minimum of 5-foot candle illumination shall be provided at the surface in all work areas. When fluorescent lighting fixtures are used, supervisors will ensure that any stroboscopic effect with moving machinery is avoided.

1.2.1.6. Guards for Floor and Wall Openings:

1.2.1.6.1. Every floor opening, such as a hatchway, chute, pit, trap door, manhole, and ladderway shall be guarded. The type of guard used is dependent on the location, reason for the opening, and frequency of use. One of the following guards shall be installed: (29 CFR 1910.23)

- Standard Railings and Toeboards. These railings and toeboards will be permanently attached leaving only one exposed side. The exposed side will have a removable railing. When the exposed side is not in use, the railing will be installed.
- Floor Opening Cover. For less frequently used openings where traffic across the opening prevents the use of fixed railings, such as openings located in aisle spaces, a cover will be used. Cover strength specifications will have the same rated load capacity as the floor. Cover design, installation, and related hardware will not present a tripping hazard. The cover will be in place when the opening is not in use. The opening will be protected by removable railings leaving only one exposed side when the cover is open or removed. There shall be someone in constant attendance at the exposed side whenever the worker is not present.

1.2.1.6.2. Every stairway and ladderway opening will be guarded by standard railings and toeboards on all open sides, except at the entrance of the opening. If there is danger of a person walking straight into the opening, a swinging gate or offset passage will be used.

1.2.1.6.3. Every covered opening in a surface, such as a skylight floor opening, shall be guarded by a skylight screen or standard railing with toeboards on all exposed sides. Screens are normally designed of grillwork or slatwork and mounted to ensure they can withstand a load of 200 pounds applied at any area of the screen.

1.2.1.6.4. All open-sided floors, platforms, and runways 4 feet or more above the ground shall be guarded on all open sides. Guards shall consist of standard railings. Toeboards are required wherever falling objects may present a hazard. Collapsible or removable sections of railings may be installed on a runway. These sections will only be removed when a special task such as oiling, shafting, or filling tank cars is being performed and other protective measures, approved by the base ground safety officials, are used. Railings shall be reinstalled when the task has been completed.

1.2.1.6.5. Every permanent or temporary wall opening (to include windows) located less than 3 feet above the floor (where there is a 4 foot or more drop) will be guarded. Guards include railings, doors, slats, grillwork, half-doors, or equivalent protection. The guard may be removable, but will be installed when the opening is not in use. A toeboard will be installed when falling materials may present a hazard. Grab handles shall be installed on each side of the opening when the operation requires reaching through or around the unprotected opening.

1.2.1.6.6. Following are general specifications for standard railings and toeboards. For specific detail on construction and installation, 29 CFR 1910.23 will be used.

- Guard railings consist of securely mounted top rails, intermediate rails, and posts. They have a height of 36 to 44 inches from the floor. Heights greater than 44 inches are permissible, but may require midrailings if the opening beneath the top rail is 19 inches or greater. Screens, mesh, vertical posts, or panels may be used in place of midrails, provided the material used can withstand a force of at least 150 pounds.
- Toeboards can be constructed of any 4-inch high rigid material, either solid or with openings not greater than 1 inch. They will be securely fastened in place with not more than one-fourth inch clearance from the floor.

1.2.2. Exterior Walking and Working Surfaces. The proper layout and condition of exterior surfaces is important to the safe and efficient movement of people and equipment. The placement of walkways and parking areas is controlled by the base CE. However, changes in workplace requirements, weather conditions, and an increase in assigned personnel strength could involve the supervisor in rerouting pedestrian or equipment traffic. Following are basic layout and condition requirements for exterior walking and working surfaces.

1.2.2.1. Loading Docks. Frequently used loading docks should be located away from principal streets and intersections. Vehicles parked at docks will not block general vehicular traffic unless control devices, such as cones, barricades, or warning signs, are used to redirect traffic.

1.2.2.1.1. The surfaces of docks will be smooth and even. Where necessary, aisleways should be marked. Edges of docks will be marked when there is a chance of workers falling. Markings will be 4-inch wide yellow lines. Where the potential exists for serious injury, removable railings will be used.

1.2.2.1.2. The width of a dock will be 2 feet wider than the widest vehicle or more common material being transported. Additional clearance will be provided to permit safe turns.

1.2.2.2. Parking Lots. The surface of parking lots should be smooth, have good drainage, and be free of pedestrian tripping hazards. Stony or rough ground should be avoided. Walkways should be provided. Entrances and exits will not have obstructions that block a driver's or pedestrian's view of traffic. Supervisors should contact the installation ground safety office and base CE for

more detailed information. Specifications for signs are contained in Air Force Pamphlet (AFPAM) 32-1097, *Sign Standards.*

1.2.2.3. Walkways. Exterior walkways will be kept clear of obstacles that block the right-of-way or present slipping and tripping hazards. Facility managers are responsible for the removal of accumulated snow or ice. Abrasive materials, such as salt or other snow melting material, will be used on walking surfaces when it is impractical or impossible to remove snow and (or) ice. Night lighting will be used to highlight hazards. When loose gravel or crushed rock is used for surfacing, the largest dimensions of material used will not exceed one-half of an inch. Motorized vehicles should not be operated over elevated walkways unless the load bearing capacity of the walkway will support the vehicle's weight. Broken or uneven cracked surfaces will be repaired.

1.2.2.4. Grounds. All grounds adjacent to work areas will be kept free of hazardous materials, trash, weeds, and unguarded pits, openings, or obstacles.

1.2.2.4.1. Materials will not be stored, left under, or piled against buildings, doors, exits, stairways, or sub-floors of data processing installations.

1.2.2.4.2. During the growing season frequent lawn mowing and edging is necessary to keep base grounds in good condition. Poisonous or toxic plants will not be used for landscaping without prior approval of the base medical services. Weeds will not be permitted to grow excessively or to accumulate. Trees and bushes adjacent to walkways will be trimmed to permit a clear path for pedestrians.

1.2.2.4.3. All open drainage ditches that present a hazard will be clearly identified in the daytime, guarded by fences or barriers, and illuminated or marked with warning flashers at night.

1.2.2.5. Construction. All construction work will be clearly identified by signs that can be read from at least 50 feet, in addition to barriers marked with night reflective materials. Illumination or warning flashers will also be used for easy sighting after dark.

1.3. Other Reference . American National Standards Institute (ANSI) Standard A12.1-1973, *Safety Requirements for Floor and Wall Openings, Railings, and Toeboards.*

Chapter 2

FIXED INDUSTRIAL STAIRS AND RAMPS

2.1. Hazards and Human Factors . Many injuries that occur each year in the Air Force are the result of falls; most take place when people move from one level to another on stairs or ramps. Proper design and construction will help prevent these falls. Other aids, such as a fixed handrail, reduce the threat of slips. Poor lighting or housekeeping, faulty treads, and slippery surfaces are unsafe conditions which often lead to injuries. Others result when people run up or down stairs, fail to use handrails, wear shoes with slippery soles and (or) heels, or are careless.

2.2. Requirements . The selection of a particular type of fixed industrial stairway or ramp over another is mostly dependent upon the location, intended use, and existing environmental conditions. The selection of stairways and ramps is normally performed by the base CE with recommendations from the ground safety office and fire department. The main concern of a supervisor should be the construction and maintenance of installed industrial stairs, ramps, and inclined ladders.

2.2.1. Design Consideration. Stairway and ramp designs are important to the supervisor. They may have been based on the prior use of a facility, whereas the current use may dictate modifications or replacement of components. This could include changing the width, angle of rise, length and vertical clearance, as well as increasing load bearing capacity, inclusion of railings, or enclosing open risers. The following minimum specifications and requirements shall be used for inspection criteria. They should be supplemented as necessary with specific design criteria available through the base CE and ground safety offices.

2.2.1.1. Strength. Fixed stairs and ramps will be designed and built to carry a load of five times the normal live load anticipated but never of less strength than to safely carry a moving concentrated load of 1,000 pounds. (29 CFR 1910.24)

2.2.1.2. Width. Fixed stairs, if part of the exit access, shall have a minimum width of 36 inches if the occupant load of the building or structure is less than 50 persons. If the occupant load is greater than 50, the minimum stair width is 44 inches. Fixed ramps, if part of the exit access, shall have a minimum width of 44 inches. The authority having jurisdiction can reduce this requirement to 30 inches in certain cases. For ramps or stairs not part of the exit access, a minimum width of 22 inches shall be provided. (NFPA 101, 29 CFR 1910.24)

2.2.1.3. Angle of Rise. Stairs must meet the requirements of NFPA 101. Fixed stairs not part of the exit access shall be installed at angles to the horizontal of between 30 degrees and 50 degrees. For existing stairs that are part of the exit access, a maximum riser height of 8 inches and minimum tread depth of 9 inches is allowed. Tread depth and riser height must be consistent throughout a new facility with a riser height ranging between 4 to 7 inches and a minimum tread depth of 11 inches. Tread depth and riser heights must also be consistent throughout a staircase. Where the slope is less than 30 degrees, a ramp with a non-slip surface should be installed. Any uniform combination of rise and (or) tread dimensions may be used. (Table 2.1 contains recommended dimensions; however, the rise and (or) tread combinations are not limited to those given.) (29 CFR 1910.24)

2.2.1.4. Ramps. Ramps not part of the exit access will be installed following the guidance in table 2.2. For ramps that are part of the exit access, a maximum slope of 1 to 8 inches is allowed and shall meet the requirements of NFPA 101.

2.2.1.5. Width of Landings. Landings and platforms not part of the exit access will be no less than the width of the stairs and a minimum of 30 inches in length, measured in the direction of travel. When doors or gates open directly onto a stairway, they shall not reduce the available width of the landing to less than 20 inches (29 CFR 1910.24). For landings in stairs or ramps that are part of the exit access, the requirements of NFPA 101 shall be met.

2.2.1.6. Vertical Clearance. Where there is less than 7 feet of headroom over stairs, obstructions will be padded. When they cannot be padded, obstructions will be color coded to highlight the hazards. Yellow or yellow-and-black stripes will be used to highlight the hazard. In all cases, caution signs will be used to warn people of low clearances. (29 CFR 1910.24)

2.2.1.7. Risers. Stairs having tread depth of less than 9 inches in width should have open risers. Stairs of 9 inches or more may also have open risers. Risers shall be from 6-1/2 to 9-1/2 inches high (29 CFR 1910.24). For risers in stairs that are part of the exit access, the requirements of NFPA 101 shall be met.

2.2.1.8. Grating. Open grating type treads are desirable for stairs which are not enclosed. The use of open treads prevents the buildup of rainwater and snow on the tread surface.

Table 2.1. Uniform Combination of Stairway Rise and Tread Dimensions.

Angle to Horizontal	Rise (In Inches)	Tread Run (In Inches)
30o 35’	6 1/2	11
32o 08’	6 3/4	10 3/4
33o 41’	7	10 1/2
35o 16’	7 1/4	10 1/4
36o 52’	7 1/2	10
38o 29’	7 3/4	9 3/4
40o 08’	8	9 1/2
41o 44’	8 1/4	9 1/4
43o 22’	8 1/2	9
45o 00’	8 3/4	8 3/4
46o 38’	9	8 1/2
48o 16’	9 1/4	8 1/4
49o 54’	9 1/2	8

2.2.1.9. Stair Railings and Guards: (29 CFR 1910.23 and 1910.24)

2.2.1.9.1. Every flight of fixed industrial stairs that has four or more risers will be equipped with standard guardrails or standard handrails as called for below. The width of the stair will be measured clear of all obstructions except handrails.

- Stairs less than 44 inches wide having both sides enclosed will have at least one hand-rail, preferably on the right side going down.
- Stairs less than 44 inches wide having one side open will have at least one guardrail on the open side.
- Stairs less than 44 inches wide having both sides open will have one guardrail on each side.
- Stairs more than 44 inches wide but less than 88 inches wide will have a handrail on each enclosed side and a guardrail on each open side.
- Stairways 88 or more inches wide will have one handrail on each enclosed side, one guardrail on each open side, and one intermediate guardrail built midway of the width.

2.2.1.9.2. Spiraling and winding stairs will have a handrail offset to stop people from walking on the parts of the treads that are less than 6 inches wide.

2.2.1.10. Illumination. Stairs and ramps will be lighted with a minimum of 5-foot candles of light so all treads and landings will be visible.

2.2.1.11. Inclined Ladders. In some Air Force facilities, space limitations resulted in permanent stairways being installed which exceeded the 50-degree angle. These constructions are commonly referred to as inclined ladders. Where an inclined ladder has been installed, it will have handrails on both sides and open risers. New construction will have stairs installed within the preferred range of 30-50 degrees.

2.2.2. Maintenance. Stairs and ramps will be kept clean, free of obstructions or slippery substances, and in good repair at all times. Supervisors will ensure:

2.2.2.1. Loose boards, insecure treads, protruding nails, and torn or worn stair treads are repaired or replaced immediately.

2.2.2.2. Slippery or worn treads and surfaces are either replaced or made safe by coating them with nonslip surface materials.

2.2.2.3. Treads and risers are of uniform size.

2.2.2.4. Stair nosings are securely fastened and rounded or beveled to prevent personnel from catching their heels on the treads.

2.2.2.5. Guardrails and handrails are smooth, free of splinters or burrs, and securely mounted.

2.2.2.6. Outside stairways and ramps are cleared of snow and ice and abrasive materials, such as sand or salt, are readily available and used during inclement weather.

Table 2.2. Ramp Installation Dimensions. (NFPA 101, Life Safety Code, Ramps, Classification)

	CLASS A	CLASS B
Width	44 inches (112 cm)	30 inches (76 cm)
Slope	1 in 10 inches	1 in 8 inches

Maximum height between landings	12 feet (3.7 m)	12 feet (3.7 m)

Chapter 3

FIXED LADDERS

3.1. Hazards and Human Factors. Most falls are caused by using ladders that are in poor condition and (or) unsafe acts such as running up and down, jumping, reaching too far out to the sides when working, and workers being physically unfit for this activity. These hazardous acts and conditions can be prevented by the proper selection and training of workers; supervisory enforcement of safe ladder use; and proper design, installation, and maintenance of fixed ladders and climbing devices.

3.2. Requirements:

3.2.1. Acquisition. Fixed ladders, their parts and accessories, and safety devices will be procured to meet the requirements of 29 CFR 1910.27. Procurement specifications will include permanent treatment for corrosion control so future treatment will not be needed. Refer to Mil Specs for protective coating criteria.

3.2.2. Design and Installation. Fixed ladders are provided as a means of access to roofs, pits, silos, towers, tanks, and other limited-access areas. Fixed industrial stairs should be provided where access is daily or during each shift for gauging, inspection, regular maintenance, or when carrying tools or equipment is normally required and sufficient space is available. The base CE selects the type of fixed ladder after determining that a stairway cannot be used. This selection will vary due to location and environmental conditions. The following paragraphs do not address the selection process but do provide general design and installation criteria for use by civil engineers and supervisors.

3.2.2.1. Length. Ladders 20 feet or less should be of a continuous length. When they are more than 20 feet and of continuous length, the following requirements shall be considered (29 CFR 1910.27):

3.2.2.1.1. Landing Platforms. A landing platform is provided for a person to rest or gain access to another section of the ladder. Platforms will be provided every 30 feet, or fraction thereof. The platform will not be less than 24 inches wide by 30 inches long and will be equipped with standard railings. Toeboards are required where the hazard of objects falling is present. (29 CFR 1910.27)

3.2.2.1.2. Ladder Safety Devices, Cages, and Wells. Cages and wells merely contain a falling climber rather than restricting the distance of fall. Therefore, new procurement of a fixed ladder (where fall protection is required) shall include a safety climb device rather than a cage or well. Where a cage or well is installed, specific design and construction information is contained in ANSI Standard Al4.3, *Safety Requirements for Fixed Ladders*. Ladder safety devices, cages, or wells are required on all fixed ladders 20 or more feet.

3.2.2.2. Ladder Pitch. The preferred pitch of fixed ladders will be in the range of 75 to 90 degrees from the horizontal. Any pitch below 75 degrees is substandard and will be avoided. Ladders with a pitch in excess of 90 degrees are prohibited. (29 CFR 1910.27)

3.2.2.3. Load Capacity. All ladders, platforms, appurtenances, and fastenings will be designed to meet the load requirements of 29 CFR 1910.27.

3.2.2.4. Lighting. Adequate illumination will be provided when ladders are used under conditions of inadequate visibility. A minimum lighting intensity of 5-foot candles is recommended. Lamps should be installed so the light does not reflect in a climber's eyes.

3.2.2.5. Access. Where unauthorized use of a fixed ladder is a problem, such as in a public area, the bottom 7 feet should be guarded. Examples of guarding include the use of a fence with locked gates and making the bottom portion portable or spring loaded and available only as needed. Additionally, there must be a warning sign to prohibit access by unauthorized persons.

3.2.2.6. Slipping. When the potential for climbers to get mud, oil, or grease on their footwear creates a slipping hazard, a mat of crushed rock, a raised platform, or a boot scraper should be provided.

3.2.2.7. Electric Lines. Electrical conductors will not be installed on or adjacent to fixed metal ladders, unless they are beyond reach and cannot be used as a handrail or grabbed in an emergency. This distance should be at least 5 feet from the ladder. If there is any potential for contact with parts of electric equipment or circuits, these parts shall be de-energized and locked out according to AFOSH Standard 91-45, *Hazardous Energy Control and Mishap Prevention Signs and Tags.*.

3.2.2.8. Iron Rung Ladders. Iron rung ladders shall be built into the walls of each manhole over 12 feet deep. The distance between rungs is the same as other fixed ladders. More detailed design criteria can be found in 29 CFR 1910.27 and ANSI Al4.3.

3.2.2.9. Grounding and Bonding. Ladders and related equipment will be grounded and (or) bonded, to drain off accumulated static electricity when used where static electricity is hazardous to the work operation, such as fuel cell repair or refueling vehicle maintenance. Static discharge plates will also be provided.

3.2.3. Inspections:

3.2.3.1. A formal, fully documented inspection of all fixed ladders will be accomplished upon installation and at least every 3 years thereafter. These inspections will be performed by base CE for ladders installed on real property facilities or real property installed equipment (RPIE). The using organization is responsible for ensuring inspections are done for facilities and equipment which are not real property. When qualified personnel are not available in using organizations, base civil engineers will provide assistance. Inspection documentation will include the type ladder and safety climb device installed, location, a detailed list of all discrepancies, and corrective action status.

3.2.3.2. Climbers will be alert to potential hazards and perform informal inspections of fixed ladders prior to every use. No attempt to climb will be made until all hazardous conditions are corrected. Specific hazards to look for during inspections are: loose, worn, and damaged rungs or side rails; damaged or corroded bolts and rivet heads; damaged or corroded handrails and brackets on platforms; and deteriorated masonry where fixed ladder anchorages are secured to a structure, including loose or damaged carrier rails or cables.

3.2.4. Maintenance. When repairs are made to fixed ladders and related equipment, the following requirements shall be met:

3.2.4.1. The materials used will be at least the equivalent of the original construction.

3.2.4.2. Any modification to ladder components, safety climb device, or related equipment will be approved by base CE, the property manager, and base ground safety officials.

3.2.4.3. All welding will be performed by a welder experienced in the materials of the fixed ladder.

3.2.5. Selection of Personnel. There are individuals who become spatially disoriented when they are working on elevated ladders or platforms and can see the ground or floor some distance below them. This condition is known as height vertigo. Common reactions to this condition are to "freeze" and hang on to any permanent support or to experience dizziness, nausea, trembling, and (or) loss of consciousness. Supervisors will be especially vigilant in screening and observing newly hired or newly assigned personnel when it is expected that they will be required to work in elevated locations as part of their job. Workers descending into pits or shafts also may experience vertigo. These individuals should be disqualified as ladder users.

3.2.6. Ladder Use. Continued safe use of ladders requires proper climbing practices at all times. Supervisors shall ensure climbers are trained to:

3.2.6.1. Check ladder for defects and slippery substances.

3.2.6.2. Ensure ladder and climber's feet are free of slippery substances.

3.2.6.3. Never carry tools or materials by hand while climbing. Raise or lower needed tools and materials by handlines after attaining the work position.

3.2.6.4. Face the ladder and use both hands to grip the rungs or side rails firmly.

3.2.6.5. Wear slip-resistant shoes with heels.

3.2.6.6. Climb carefully, without haste. Never run up or down, nor slide down the ladder.

3.2.6.7. Never jump from the ladder.

3.2.6.8. Remove hand jewelry (rings) prior to climbing.

Chapter 4

PORTABLE LADDERS

4.1. Hazards and Human Factors. Falls are the primary hazard associated with the use of portable ladders. Falls result from a number of unsafe acts and conditions such as:

4.1.1. Ladders being set on unstable surfaces.

4.1.2. Personnel reaching too far out to the sides.

4.1.3. Personnel standing too high to maintain balance.

4.1.4. Personnel using defective ladders (i.e., broken rails, rungs, missing hardware).

NOTE:

These hazards are minimized if workers adhere to proper ladder discipline and if supervisors ensure equipment is inspected, maintained in good condition, and properly used.

4.2. Requirements:

4.2.1. Acquisition and Selection Considerations**:**

4.2.1.1. Portable ladders acquired for the Air Force will meet the design and construction specifications of Mil Specs identified in table 4.l. When no Mil Specs exist, ANSI Standards identified in table 4.2 will be used. Personnel needing access to these ANSI standards will contact their installation ground safety representative for guidance.

EXCEPTION: Fire department ladders will be maintained and inspected according to NFPA Standards 1931, *Design of and Design Verification Tests for Fire Department Ground Ladders*, and 1932, *Use, Maintenance, and Service Testing of Fire Department Ground Ladders.*

4.2.1.2. There are a variety of ladder styles the supervisor can choose. The selection, to include construction material and proper size, will be based on where and how the ladder may be used. This chapter addresses step and extension ladders and the three most common materials used in their construction, i.e., wood, metal, and fiberglass. However, the general guidance presented is applicable to most portable ladders used in the Air Force. MAJCOM, DRU, and FOA ground safety staffs will determine its applicability to special purpose ladders not adequately covered by Mil Specs and ANSI standards.

4.2.1.2.1. Ladders come in four workload ratings. Table 4.3 gives the basic differences in these ladders. Supervisors will order TYPE IA or I whenever possible. TYPE II ladders should only be considered when local purchase is required and local manufacturers cannot provide TYPE IA or I. Due to the significant workload limitations of Type III ladders, they should not be procured for industrial use.

4.2.1.2.2. The supervisor will consider the location as well as durability when selecting the best material. Aluminum ladders are normally lighter than wood while steel ladders are as heavy or heavier. Metal ladders and wood ladders with metal reinforced side rails shall not be used in areas where a worker or the ladder could contact exposed energized electrical circuits. Carrying steel and wood ladders is fatiguing if the worker has to carry them for a considerable distance.

4.2.2. Inspections**.** Thorough visual inspections of ladders will be made by the supervisor when the ladder is initially received and prior to being placed in service. Workers will perform a visual inspection prior to each use. Defects or damage to look for include: (29 CFR 1910.25)

4.2.2.1. Evidence the ladder was exposed to excessive heat (such as in a fire) or to corrosive substances. When ladders are so exposed, their ability to support the designed working load should be questioned. The ladder should be retested according to ANSI standards.

4.2.2.2. Side rails, steps, rungs, or related hardware that are cracked, split, or deformed.

4.2.2.3. Pulleys, cables, and ropes which bind or are frayed.

4.2.2.4. Rivets, connections, and spreaders for looseness or shearing.

4.2.2.5. Nonskid base material that is loose or missing. Metal and metal-reinforced single and extension ladders, except aircraft boarding ladders, will be equipped with safety shoes, spurs, spikes, or combinations thereof to prevent slipping.

4.2.2.6. Metal and metal reinforced ladders that are not marked for electrical hazards. Ladders not marked with safety use instructions by the manufacturer shall be stenciled, **"DANGER — DO NOT USE AROUND ELECTRICAL EQUIPMENT,"** in 2-inch high red letters or the largest letters the surface will allow (minimum letter size is 1 inch).

4.2.2.7. Rungs or steps on metal or fiberglass ladders that are not corrugated, knurled, dimpled, or in some way made skid resistant.

4.2.2.8. Ladders with broken or missing steps, rungs or cleats, broken side rails, or other defects. Ladders with these defects will not be used.

4.2.3. Maintenance**.** Proper maintenance ensures the safe condition of the ladder. Hardware, fittings, and related equipment will be checked frequently and kept in proper working condition. All bolts and rivets will be in place and secured. Joints between steps or rungs and the side rails will be tight. (29 CFR 1910.26)

4.2.3.1. Lubricate metal bearings of locks, wheels, pulleys, etc., as required to keep them working.

4.2.3.2. Replace frayed or worn rope.

4.2.3.3. Keep safety feet and other parts in good condition to ensure they work.

4.2.3.4. Coat wood, metal, and plastic ladders with a suitable protective material when required. Do not paint wood ladders with an opaque coating, since possible defects may be covered up. If protective coatings are considered desirable for wooden ladders, use only transparent coatings or wood preservatives. Protect metal ladders that may come in contact with acids or alkali solutions with a locally approved coating. When location demands, protect metal ladders against corrosion caused by moisture or salt spray. Wash plastic ladder rails with surface appearance of exposed fibers or an apparent color change due to exposure to the weathering cycle with a mild liquid detergent solution and allow them to air dry. Spray or brush the ladder rails with acrylic lacquer, epoxy, or other locally approved coating sufficient to cover the exposed fibers. Following the first coat, lightly sand the fiberglass surface with "00" sandpaper, or equivalent, to smooth the glass bristles. Ensure that rungs and steps designed for use in ascending or descending on metal or plas-

tic ladders are corrugated, knurled, dimpled, or coated with skid-resistant materials. (ANSI A14.5, *Safety Requirements for Job-Made Ladders*)

4.2.3.5. Remove from service ladders with defects which cannot be immediately repaired and ensure they are scheduled for repair or destruction. Use an AF Form 979, ***Danger Tag***, to warn workers that the ladder cannot be used. If a ladder is to be discarded, remove it from the maintenance area and cut it in half to prevent further use. Do not attempt to straighten or use a bent ladder made of fiberglass.

4.2.4. Personnel Training. Personnel who use ladders with working height of 6 foot or more will be adequately trained in the care and use of different types of ladders. The supervisor or a designated trainer will conduct this training when a worker is first assigned. (Refer to paragraph 3.2.6. of this standard). Information presented during safety briefings will satisfy the periodic training requirement. All training will include hands-on instruction to include inspection of ladders for defects, possible electrocution hazards, proper positioning, and placement of ladders for various job sites. Training will be documented according to instructions in AFI 91-301.

4.2.5. Care and Use of Ladders: (29 CFR 1910.25 and 1910.26)

4.2.5.1. Requirements Applicable to All Ladders:

4.2.5.1.1. Handle ladders with care. Do not drop, jar, or misuse them.

4.2.5.1.2. Store ladders in a way that provides easy access for inspection and permits safe withdrawal for use. When possible, store ladders on racks. Ensure the racks have enough supporting points to keep the ladders from sagging. Do not place material on stored ladders. Store wood ladders in a location free from exposure to the elements and excessive heat or dampness.

4.2.5.1.3. Properly support ladders being transported (horizontally or vertically) on vehicles. Make sure supporting points are of a soft material, such as hardwood or rubber-covered iron pipe, to minimize the chafing and effects of road shock (tying the ladder to each support point could reduce damage due to road shock).

4.2.5.1.4. Place portable ladders so the side rails have a secure footing. Ensure the top rest for portable rung and cleat ladders is reasonably rigid and has adequate strength to support the applied load.

4.2.5.1.5. Do not place ladders in front of doors which open toward the ladder unless the door is blocked open, locked, or guarded.

4.2.5.1.6. Do not place ladders on boxes, barrels, or other unstable bases to obtain additional height.

4.2.5.1.7. Face the ladder when ascending or descending.

4.2.5.1.8. Do not use ladders as guys, braces, skids, horizontal platforms or scaffolds, or for other than their intended purposes.

4.2.5.1.9. Do not consider nonslip bases (safety feet) as a substitute for care in safely placing, lashing, or holding a ladder that is being used upon oily, metal, concrete, or slippery surfaces.

4.2.5.1.10. Fasten the ladder securely when the ladder can be knocked over by others who are working in the area. As an alternative, assign someone to steady the bottom or protect the area around the ladder against personnel or vehicular traffic.

4.2.5.1.11. Do not stand on the top cap of trestle or combination ladders, nor the top step of stepladders (three-step aircraft ladders exempted). MAJCOM, DRU, and FOA ground safety staffs will evaluate and provide guidance for military-unique operations.

4.2.5.1.12. Allow only one person on a portable ladder at any time, unless designed for use by two people.

4.2.5.1.13. When acending or descending a ladder, face the ladder and maintain a firm hold on the ladder.

4.2.5.1.14. Do not place ladders on gratings unless the base can be lashed or secured to prevent slippage.

4.2.5.1.15. Perform work requiring the use of both hands only on stepladders or platform ladders.

4.2.5.1.16. Do not leave ladders in place unattended.

4.2.5.1.17. Do not use portable metal or metal reinforced ladders when performing work on or near electrical equipment, but use wood or fiberglass ladders. Keep them clean. Remove all surface buildup of dirt, grease, or oils to avoid creating a ready path for electrical current. (29 CFR 1910.333)

4.2.5.2. Additional Requirements for Extension Ladders:

4.2.5.2.1. Where possible, portable non-self-supporting ladders will be used at such a pitch that the base of the ladder is placed a distance from the vertical wall that is one-fourth of the working length of the ladder (the length along the ladder between the foot and the top support). The ladder will be placed to prevent slipping or it will be lashed or manually held in position.

4.2.5.2.2. To support the top of the ladder at a window opening, a board will be attached across the back of the ladder, extending across the window to provide firm support against the building walls or window frames. (ANSI 14.1-1982)

4.2.5.2.3. Short ladders will not be spliced together to provide long sections.

4.2.5.2.4. The minimum overlap for the two sections of two-section extension ladders is listed in table 4.4.

4.2.5.2.5. Portable rung ladders with reinforced rails will be used only with the metal reinforcement on the underside. Ladders of this type will not be used near electrical conductors since the reinforcing itself is a good conductor.

4.2.5.2.6. A ladder will not be used to gain access to a roof unless the top of the ladder extends at least 3 feet above the point of support at eave, gutter, or roof line.

4.2.5.2.7. Adjustment of extension ladders will be made by the user only when standing at the base of the ladder, so the worker can see when the locks are properly engaged.

4.2.5.2.8. The middle and top sections of sectional or window cleaner's ladders will not be used for bottom sections unless equipped with nonslip bases (safety feet).

4.2.5.2.9. Extension ladders will always be raised so the upper section overlaps and rests on the bottom section. The upper section will always overlap on the climbing side of the extension ladder.

4.2.5.2.10. Hooks may be attached at or near the top of portable ladders to provide added stability.

4.2.5.3. Additional Requirements for Stepladders:

4.2.5.3.1. Ladders will not be used by more than one person at a time unless the ladder was specifically designed for use by two people. Ladders specially designed to support greater loads will be used in combination with ladder jacks and scaffold planks when an operation requires more than one person. (ANSI Standard A10.8, *Safety Requirements — Construction and Demolition Operations — Scaffolding.)*

4.2.5.3.2. The bracing on the back legs of stepladders will not be used for climbing because it is designed solely for increasing stability.

Table 4.1. Military Specifications on Ladders.

Number	Title
MIL-L-54002B	Ladder, Aluminum, Three Way Combination, Step, Straight, Extension.
MIL-L-17447	Ladder, Debarkation, Fiber Rope
MIL-L-12197F	Ladders, Fire, Extension, Ladders, Fire Roof; and Ladders, Fire, Combination.
MIL-L-6378C	Ladder, Folding Refueling.
MIL-L-52825	Ladder, Hanging.
MIL-L-221C	Ladder, Jacobs.
LLL-L-51C(2)	Ladder, Portable, Wood: Extension and Straight.
RR-L 100E and RR-6-100E	Ladder, Safety Step (Metal, Rollable).
RR-L-91D(l)	Ladder, Straight, Extension and Trestle.

Table 4.2. ANSI Standards on Ladders.

NUMBER	TITLE
A14.1	Portable Wood Ladders.

A14.2	Portable Metal Ladders.
A14.5	Portable Reinforced Plastic Ladders (Includes Fiberglass Specifications).

Table 4.3. Ladder Workload Ratings.

Duty Rating	Ladder Type	Working Load (Pounds)
Extra heavy duty	IA	300
Heavy duty	I	250
Medium duty	II	225
Light duty	III	200

Table 4.4. Dimensions for Overlap of Sectional Ladders.

Nominal Ladder Length:	Overlap
36 feet and less	3 feet
Over 36, up to and including 48 feet	4 feet
Over 48, and up to 60 feet	5 feet

FRANCIS C. GIDEON, JR., Maj General, USAF
Chief of Safety

Attachment 1

GLOSSARY OF REFERENCES, ABBREVIATIONS, ACRONYMS, AND TERMS

References

Air Force Instruction (AFI) 91-201, *Explosives Safety Standards*.

AFI 91-301, *Air Force Occupational and Environmental Safety, Fire Protection and Health (AFOSH) Program.*

Air Force Joint Manual (AFJMAN) 32-10131V1, *Sanitary and Industrial Wastewater Collection, Gravity Sewers, and Appurtenances.*

AFJMAN 32-10131V3, *Domestic Wastewater Treatment.*

Air Force Occupational Safety and Health (AFOSH) Standard 91-2, *Vehicle-Mounted Elevating and Rotating Work Platforms, Manually-Propelled and Self-Propelled Mobile Work Platforms and Scaffolds (Towers)* (formerly designated as AFOSH Standards 127-9 and 127-47).

AFOSH Standard 91-45, *Hazardous Energy Control and Mishap Prevention Signs and Tags* (formerly designated as AFOSH Standard 127-45).

Air Force Pamphlet (AFPAM) 32-1097, *Sign Standards* (formerly designated as Air Force Pamphlet [AFP] 88-40).

Air Force 32-Series, *Civil Engineering,* Publications.

AFR 86-Series, *Civil Engineering Planning, Programming, and Design.*

AFR 88-11 V1, *Sanitary and Industrial Wastewater Collection, Gravity Sewers, and Appurtenances.*

AFR 88-11 V3, *Domestic Wastewater Treatment.*

American National Standards Institute (ANSI) Standard Al0.8, *Safety Requirements — Construction and Demolition Operations — Scaffolding.*

ANSI Standard A12.1, *Safety Requirements for Floor and Wall Openings, Railings, and Toeboards*.

ANSI Standard A14.1, *Safety Requirements for Portable Wood Ladders*.

ANSI Standard A14.2, *Safety Requirements for Portable Metal Ladders.*

ANSI Standard A14.3, *Safety Requirements for Fixed Ladders.*

ANSI Standard A14.4, *Safety Requirements for Job-Made Ladders*

ANSI Standard A14.5, *Safety Requirements for Portable Reinforced Plastic Ladders.*

National Fire Protection Association (NFPA) 70, *National Electrical Code.*

NFPA 101, *Code for Safety to Life From Fire in Buildings and Structures.*

NFPA 1931, *Design of and Design Verification Tests for Fire Department Ground Ladders*.

NFPA 1932, *Use, Maintenance, and Service Testing of Fire Department Ground Ladders.*

Occupational Safety and Health Administration (OSHA) 29 Code of Federal Regulations (CFR) 1910, Subpart D, *Walking--Working Surfaces*.

OSHA 29 CFR 1910.21, *Definitions--Walking--Working Surfaces*.

OSHA 29 CFR 1910.22, *General Requirements.*

OSHA 29 CFR 1910.23, *Guarding Floor and Wall Openings and Holes*.

OSHA 29 CFR 1910.24, *Fixed Industrial Stairs.*

OSHA 29 CFR 1910.25, *Portable Wood Ladders.*

OSHA 29 CFR 1910.26, *Portable Metal Ladders*.

OSHA 29 CFR 1910.27, *Fixed Ladders*.

OSHA 29 CFR 1910.30, *Other Working Surfaces.*

OSHA 29 CFR 1910.37, *Means of Egress, General.*

OSHA 29 CFR 1910.176, *Handling Materials--General*.

OSHA 29 CFR 1910.303, *General Requirements.*

OSHA 29 CFR 1910.333, *Selection and Use of Work Practices*.

Abbreviations and Acronyms

AFI—Air Force Instruction (new designation)

AFOSH—Air Force Occupational Safety and Health

AFP—Air Force Pamphlet (obsolete designation)

AFPAM—Air Force Pamphlet (new designation)

AFSC—Air Force Safety Center

ANSI—American National Standards Institute

BE—Bioenvironmental Engineering

BEE—Bioenvironmental Engineer

CE—Civil Engineering

CFR—Code of Federal Regulations

DRU—Direct Reporting Unit

FOA—Field Operating Agency

MAJCOM—Major Command

Mil Spec—Military Specification

NEC—National Electrical Code

NFPA—National Fire Protection Association

OSHA—Occupational Safety and Health Administration

PDO—Publishing Distribution Office

RPIE—Real Property Installed Equipment

USAF—United States Air Force

WWW—World-Wide Web

Terms

NOTE:

(Reference 29 CFR 1910.21, *Definitions--Walking-Working Surfaces.)*

Aisleway—An established path for powered material handling equipment (or foot traffic) used inside an industrial facility, such as aisleways in a supply warehouse.

Cage—An enclosure that encircles the climbing space and is fastened to the side rails of the ladder or structure.

Climbing Ladder—A separate or built-in ladder with rungs that are spaced at equal distance and are attached to the platform so people can climb and descend.

Exit Access—Exit access is that portion of a means of egress that leads to an exit.

Extension Ladder—A nonself-supporting portable ladder, adjustable in length. It consists of two or more sections traveling in guides or brackets arranged to permit length adjustment. Its size is designated by the sum of the lengths of the sections measured along the side rails.

Floor—The interior walking and walking surface upon which machinery, aisles, and passageways are located. This does not include platforms, walkways, or catwalks.

Guardrail—A vertical guard built along exposed sides of stairs and platforms to stop people from falling. The top part of a guardrail can serve as a handrail.

Handrail—Single bar or pipe supported on brackets attached to a wall or partition to provide a handhold for people using stairs.

Inclined Ladder or "Ships' Ladder"—A stairway installed at an angle greater than 50 degrees. All stairway criteria, except the angle of rise, applies to inclined ladders.

Ladder—Two side rails joined at regular intervals by crosspieces called steps, rungs, or cleats.

Maximum Intended Load—The total weight of all loads including the weight of workers, materials, and scaffolding that is anticipated during a job.

May—Indicates an acceptable or satisfactory method of accomplishment.

Means of Egress—A continuous and unobstructed way of exit travel from ANY point in a building or structure to a public way (parking lot or road, etc.).

Midrail—A rail approximately midway between the guardrail and platform and secured to the uprights erected along the exposed sides and ends of platforms.

Nose, Nosing—That portion of a tread projecting beyond the face of the riser immediately below.

Open Riser—The air space between the treads of stairs.

Passageway or Walkway—A path for pedestrian and nonpowered material handling equipment. For the purpose of this standard, passageway is used for interior and walkway for exterior paths.

Pitch—The angle at which the fixed ladder is inclined against a structure or piece of equipment.

Platform—A walking or working surface for persons, elevated above the surrounding floor or ground (such as a balcony or landing) or a personnel carrying device (basket or bucket) which is a component of a mobile unit.

Rise—The vertical distance from the top of a tread to the top of the next higher tread.

Riser—The upright part of a step at the back of a lower tread and near the leading edge of the next higher tread.

Runway—A passageway for persons, elevated above the floor or ground level, such as a foot walk along shafting or a walkway between buildings. They are sometimes called catwalks.

Safety Climbing Device—A device, other than a cage, designed to limit falling distance. It may incorporate such features as life belts, friction brakes, or sliding attachments.

Sectional Ladder—A nonself-supporting portable ladder, nonadjustable in length, consisting of two or more sections constructed so it functions as a single ladder. Its size is designated by the overall length of the assembled sections.

Shall—Indicates a mandatory requirement.

Should—Indicates a preferred method of accomplishment

Single Ladder—A freestanding portable ladder, nonadjustable in length, consisting of but one section. Its size is designated by the overall length of the side rail.

Stairs—A series of steps and landings with three or more risers. Stairs may lead users from one level or floor to another, to platforms, pits, boiler rooms, crossovers, or around machinery, tanks, and other equipment.

Step—The crosspiece of a ladder on which a person may step, also called a rung or cleat. Also means a combination of risers and treads which may be a part of a stair.

Stepladder—A self-supporting portable ladder, nonadjustable in length, having flat steps and a hinged back. Its size is designated by the overall length of the ladder measured along the front edge of the side rails.

Stroboscopic Effect—The potential for fluorescent lighting to create the appearance that moving, rotating, or vibrating objects are stationary.

Toeboard—A barrier, secured along the sides and ends of a platform, to prevent material from falling from the scaffold platform.

Tread—The horizontal part of a step.

Tread Width—The horizontal distance from the front to the back of tread including nosing.

Will—Is also used to indicate a mandatory requirement and to express a declaration of intent, probability, or determination.

Attachment 2

CHECKLIST

CHAPTER 1—INTERIOR AND EXTERIOR SURFACES

This is not an all-inclusive checklist. It simply highlights some critical items in this chapter. Other requirements exist in the chapter that are not included in the checklist. Where appropriate, MAJCOMs, DRUs, FOAs, local ground safety offices, and supervisors will add to this checklist to include command or individual shop-unique requirements or situations.

Interior Walking and Working Surfaces:

Layout

A2.1. Are all pieces of equipment and machinery arranged to permit an even flow of materials?

(Reference paragraph: 1.2.1.1.1.)

A2.2. Are machines positioned so it will not be necessary for an operator to stand in a passageway, aisle, or exit access? (Reference paragraph 1.2.1.1.1.)

A2.3. Are machines positioned to allow for easy maintenance, cleaning, and removal of scrap?

(Reference paragraph 1.2.1.1.1.)

A2.4. Are passageways, aisles, and exit accesses provided to permit the free movement of employees bringing to and removing material from the shop? (Reference paragraph 1.2.1.1.2)

A2.5. Are at least 18 inches provided for passageways through or between obstructions? (Reference paragraph 1.2.1.1.4.)

Condition

A2.6. Are floors kept in good condition and free of defects that endanger workers or interfere with the handling of materials? (Reference paragraph 1.2.1.2.)

A2.7. Are floors free of obstructions which could create a tripping hazard or hinder people leaving the area during emergencies? (Reference paragraph 1.2.1.2.)

A2.8. Are floors of all shops, service rooms, halls, and storerooms kept clean and free of slippery substances? (Reference paragraph 1.2.1.2.1.)

A2.9. Are drip or oil pans used whenever the possibility of spilling or dripping exists? (Reference paragraph 1.2.1.2.1.)

A2.10. When floors are being cleaned or finishing compounds are being applied, are signs posted to warn workers of a slipping hazard? (Reference paragraph 1.2.1.2.4.)

- Do the signs remain in place until the floors are dry?
- Are these caution signs yellow with black lettering?

A2.11. Are passageways, aisles, and exit accesses kept clear for easy access to emergency equipment and to enable fire fighters to reach a fire, if necessary? (Reference paragraph 1.2.1.2.5.)

A2.12. Are areas adjacent to fire sprinkler control valves, fuse boxes, and electrical switch panels clear and unobstructed? (Reference paragraph 1.2.1.2.5.)

Loading Capacity

A2.13. Are signs identifying the floor load capacity permanently installed, in plain view of all workers? (Reference paragraph 1.2.1.3.)

Floor Sloping, Drains, and Separators

A2.14. Are drains provided when floors are subject to water, moisture, flooding, or when wet processes are used? Are drains kept clear to prevent clogging? (Reference paragraph 1.2.1.4.)

Illumination

A2.15. Are all aisles, passageways, and work areas adequately lighted? **(**Reference paragraph 1.2.1.5.)

Guards for Floor and Wall Openings

A2.16. Are all floor openings, such as hatchways, chutes, pits, trap doors, manholes, and ladderways properly guarded? (Reference paragraph 1.2.1.6.1.)

A2.17. Are all stairways and ladderway openings guarded by a standard railing and toeboards on all open sides, except at the entrance of the opening? (Reference paragraph 1.2.1.6.2.)

A2.18. Are all open-sided floors, platforms, and runways 4 feet or more above the ground guarded on all open sides? (Reference paragraph 1.2.1.6.4.)

A2.19. Are grab handles installed on each side of the opening, when the operation requires reaching through or around the unprotected opening? (Reference paragraph 1.2.1.6.5.)

A2.20. Are the general specifications for standard railings and toeboards used? Is OSHA 1910.23 consulted for specific detail on construction and installation? (Reference paragraph 1.2.1.6.6.)

Exterior Walking and Working Surfaces

Loading Docks

A2.21. Are frequently used loading docks located away from principal streets and intersections? (Reference paragraph 1.2.2.1.)

A2.22. Are the surfaces of docks smooth, even, and their edges marked or highlighted? (Reference paragraph 1.2.2.1.1.)

A2.23. Are the dock widths 2 feet wider than the widest vehicle or most common materials being transported? (Reference paragraph 1.2.2.1.2.)

Parking Lots

A2.24. Is the surface of parking lots smooth, have good drainage, and free of pedestrian tripping hazards? (Reference paragraph 1.2.2.2.)

A2.25. Are entrances and exits free of obstructions that block a driver's or pedestrian's view of traffic? (Reference paragraph 1.2.2.2.)

Walkways

A2.26. Are exterior walkways kept clear of obstacles that block the right-of-way or present slipping and tripping hazards? (Reference paragraph 1.2.2.3.)

Grounds

A2.27. Do workers ensure materials are not stored, left under, or piled against buildings, doors, exits, or stairways? (Reference paragraph 1.2.2.4.1.)

A2.28. Are poisonous or toxic plants prohibited for landscaping unless approved by the base medical services? (Reference paragraph 1.2.2.4.2.)

A2.29. Are trees and bushes adjacent to walkways trimmed to permit a clear path for pedestrians? (Reference paragraph 1.2.2.4.2.)

Construction

A2.30. Is all construction work clearly identified by signs that can be read from at least 50 feet, in addition to barriers marked with reflective materials? (Reference paragraph 1.2.2.5.)

A2.31. Are illumination or warning flashers also used for easy sighting after dark? (Reference paragraph 1.2.2.5.)

CHAPTER 2 - FIXED INDUSTRIAL STAIRS AND RAMPS

Design Consideration

Strength

A2.32. Are fixed stairs and ramps designed and built to carry a load of five times the normal live load anticipated? (Reference paragraph 2.2.1.1.)

Angle of Rise

A2.33. Are fixed stairs (not part of the exit access) installed at angles to the horizontal of between 30 and 50 degrees? (Reference paragraph 2.2.1.3.)

Ramps

A2.34. Are ramps (not part of the exit access) installed following the guidance in table 2-2? (Reference paragraph 2.2.1.4.)

Width of Landings

A2.35. When the doors or gates open directly onto a stairway, is the available width of the landing wider than 20 inches? (Reference paragraph 2.2.1.5.)

Vertical Clearance

A2.36. Where there is less than 7 feet of headroom over stairs, are obstructions padded? Where they cannot be padded, are they color coded with yellow or yellow-and-black stripes to highlight the hazard? (Reference paragraph 2.2.1.6.)

A2.37. In all cases, are caution signs used to warn people of low clearance? (Reference paragraph 2.2.1.6.)

Grating

A2.38. Are open grating type treads used on stairs which are not enclosed? (Reference paragraph 2.2.1.8.)

Stair Railings and Guards

A2.39. Are every flight of fixed industrial stairs, with four or more risers, equipped with standard guardrails or standard handrails? (Reference paragraph 2.2.1.9.1.)

A2.40. Do stairs less than 44 inches wide, having both sides enclosed, have at least one handrail, preferably on the right side going down? (Reference paragraph 2.2.1.9.1.)

A2.41. Do stairs less than 44 inches wide, having one side open, have at least one guardrail on the open side? (Reference paragraph 2.2.1.9.1.)

A2.42. Do stairs less than 44 inches wide, having both sides open, have one guardrail on each side? (Reference paragraph 2.2.1.9.1.)

A2.43. Do stairs more than 44 inches wide but less than 88 inches wide have a handrail on each enclosed side and a guardrail on each open side? (Reference paragraph 2.2.1.9.1.)

A2.44. Do stairways 88 or more inches wide have one handrail on each enclosed side, one guardrail on each open side, and one intermediate guardrail built midway of the width? (Reference paragraph 2.2.1.9.1.)

A2.45. Are spiraling and winding stairs equipped with a handrail offset to stop people from walking on the parts of the treads that are less than 6 inches wide? (Reference paragraph 2.2.1.9.2.)

Illumination

A2.46. Are stairs and ramps lighted so all treads and landings will be visible? (Reference paragraph 2.2.1.10.)

Maintenance

A2.47. Are stairs and ramps kept clean, free of obstructions or slippery substances, and in good repair? (Reference paragraph 2.2.2.)

A2.48. Are slippery or worn treads and surfaces either replaced or made safe by coating them with non-slip surface materials? (Reference paragraph 2.2.2.2.)

A2.49. Are guardrails and handrails smooth, free of splinters or burrs, and securely mounted? (Reference paragraph 2.2.2.5.)

CHAPTER 3 — FIXED LADDERS

Design and Installation

A2.50. Are fixed industrial stairs provided as a means of access to roofs, pits, silos, towers, tanks, and limited-access areas, where access is daily or during each shift for gauging, inspection, regular maintenance, etc.? (Reference paragraph 3.2.2.)

Length

A2.51. Are ladders 20 feet or less of a continuous length? (Reference paragraph 3.2.2.1.)

A2.52. When ladders are more than 20 feet and of a continuous length, are the following requirements considered:

A2.52.1. A landing platform is provided for a person to rest or gain access to another section of the ladder? (Reference paragraph 3.2.2.1.1.)

A2.52.2. Platform is provided every 30 feet, or fraction thereof? (Reference paragraph 3.2.2.1.1.)

A2.52.3. The landing platform is not less than 24 inches wide by 30 inches long and equipped with standard railings? (Reference paragraph 3.2.2.1.1.)

A2.52.4. Toeboards are provided where the hazard of objects falling is present? (Reference paragraph 3.2.2.1.1.)

Lighting

A2.53. Is adequate illumination provided when ladders are used under conditions of inadequate visibility? (Reference paragraph 3.2.2.4.)

Access

A2.54. Where unauthorized use of a fixed ladder is a problem, such as in a public area, is the bottom 7 feet guarded? (Reference paragraph 3.2.2.5.)

Electric Lines

A2.55. Are electrical conductors not installed on or adjacent to fixed metal ladders, unless they are beyond reach and cannot be used as a handrail or grabbed in an emergency? Is the installation at least 5 feet from the ladder? (Reference paragraph 3.2.2.7.)

Iron Rung Ladders

A2.56. Are iron rung ladders built into the walls of each manhole over 12 feet deep? (Reference paragraph 3.2.2.8.)

Inspections

A2.57. Are formal, fully documented inspections of all fixed ladders accomplished upon installation and at least every 3 years thereafter? (Reference paragraph 3.2.3.1.)

Maintenance

A2.58. Are modifications to ladder components, safety climb devices, or related equipment approved by base CE, the property manager, and ground safety officials? (Reference paragraph 3.2.4.2.)

Ladder Use

A2.59. Do supervisors ensure climbers are trained according to criteria in paragraph 3.2.6.)

CHAPTER 4 — PORTABLE LADDERS

Requirements

A2.60. Do workers abstain from using metal ladders and wood ladders with metal reinforced side rails in areas where they could contact energized electrical circuits? (Reference paragraph 4.2.1.2.2.)

Instructions

A2.61. Do supervisors make thorough visual inspections of ladders when the ladder is initially received and before the ladder is placed in service? (Reference paragraph 4.2.2.)

A2.62. Do workers perform an inspection of ladders prior to use? (Reference paragraph 4.2.2.)

A2.63. Are the following defects and damage looked for:

A2.63.1. Side rails, steps, rungs, or related hardware that are cracked, split, or deformed? (Reference paragraph 4.2.2.2.)

A2.63.2. Pulleys, cables, and ropes which bind or are frayed? (Reference paragraph 4.2.2.3.)

Maintenance

A2.64. Are hardware, fittings, and related equipment checked frequently and kept in proper working condition? (Reference paragraph 4.2.3.)

A2.65. Are all bolts and rivets in place and secured? (Reference paragraph 4.2.3.)

A2.66. Are joints between steps or rungs and the side rails tight? (Reference paragraph 4.2.3.)

A2.67. Are safety feet and other parts kept in good condition to ensure they work? (Reference paragraph 4.2.3.3.)

A2.68. Are wood, metal, and plastic ladders coated with a suitable protective material when required? (Reference paragraph 4.2.3.4.)

A2.69. Are wood ladders not painted with an opaque coating, avoiding a cover-up of possible defects? (Reference paragraph 4.2.3.4.)

A2.70. When location demands, are metal ladders protected against corrosion? (Reference paragraph 4.2.3.4.)

A2.71. Are ladders with defects which cannot be immediately repaired removed from service and action taken to ensure they are scheduled for repair or destruction? (Reference paragraph 4.2.3.5.)

A2.72. Are danger tags used to warn workers that the ladder cannot be used? (Reference paragraph 4.2.3.5.)

Personnel Training

A2.73. Are personnel who use ladders adequately trained by the supervisor in the care and use of different type ladders when a worker is first assigned? (Reference paragraph 4.2.4.)

Care and Use of Ladders

A2.74. Are ladders stored in a way that provides easy access for inspection and permits their safe withdrawal for use? (Reference paragraph 4.2.5.1.2.)

A2.75. Are wood ladders stored in a location free from exposure to the elements and excessive heat or dampness? (Reference paragraph 4.2.5.1.2.)